Taking an alternative perspective on language in autism
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Document Version
Publisher's PDF, also known as Version of record

Publication date:
2018

Link to publication in University of Groningen/UMCG research database

Citation for published version (APA):

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Chapter 6. General discussion
6.1 Introduction

This dissertation investigated linguistic perspective taking in children with ASD. Based on well-established problems with visual, affective and cognitive perspective taking in children with ASD, it was examined whether perspective-taking problems are also present in language. In Study 1, it was investigated whether cognitive perspective-taking deficits in children with ASD may be explained by poor verbal abilities. Studies 2, 3 and 4 addressed their interpretation of three types of linguistic expressions that have been argued to involve perspective taking, namely deictic pronouns, spatial prepositions and temporal conjunctions. The main aim of this dissertation was to investigate whether children with ASD have more problems than their typically developing (TD) peers with the interpretation of these three types of linguistic expressions. The second aim was to examine which cognitive processes may contribute to linguistic perspective taking, in particular the ability as a hearer to take the speaker’s perspective into account. Associations of Theory of Mind (ToM) understanding with the interpretation of the linguistic expression were taken as an indication of the need for perspective taking.

In this final chapter, I first provide a summary of the findings of the four studies in this dissertation. Next, these findings are discussed in the light of the two aims of this dissertation. Finally, the methodological limitations, potential theoretical and clinical implications of the findings and directions for future studies are discussed.

6.2 Summary of findings

In Study 1 (Chapter 2), we examined whether primary school-aged children with ASD struggle with ToM understanding due to verbal tasks demands rather than ToM impairments. ToM understanding was investigated in a standard high-verbal ToM task (a false belief task) and a low-verbal ToM task (a two-player visual computer game in which optimal decisions require ToM reasoning). In line with previous research (Baron-Cohen et al., 1985; Yirmiya et al., 1998), children with ASD performed worse than their TD peers on ToM understanding in the standard high-verbal ToM task. Additionally, children with ASD performed worse than their TD peers on ToM understanding in the low-verbal ToM task. We investigated which cognitive processes are involved in ToM understanding, and whether
these processes could explain why children with ASD have problems with ToM understanding. While verbal ability, working memory and IQ were found to be relevant in the high-verbal ToM task, inhibition skills and IQ were associated with ToM understanding in the low-verbal ToM task. However, why children with ASD have problems with ToM understanding could not be explained by these cognitive processes. Additionally, as children with ASD performed less well than their TD peers not only on the verbal task but also on the low-verbal task, their well-known difficulties with ToM could not be attributed to the verbal demands of the ToM task either. The findings of this study suggest that ToM impairments in children with ASD are genuine and that these impairments are not due to poor verbal abilities.

In Study 2 (Chapter 3), we investigated the interpretation of the deictic pronouns *ik* ‘I’ and *jij* ‘you’ in indirect and direct speech reports in primary school-aged children with and without ASD. Previous research showed that pronoun reversals, saying *you* when meaning *I*, are present in young children with ASD as well as their TD peers, but persist only in individuals with ASD with a low intelligence (Evans & Demuth, 2012; Naigles et al., 2016; Tager-Flusberg et al., 2005). Several explanations for pronoun reversals in children with and without ASD were tested, including the social or pragmatic explanations and the cognitive explanation, that both acknowledge that pronouns require a shift in perspective (Dale & Crain-Thoreson, 1993; Tager-Flusberg et al., 2005). We studied children’s interpretation of *I* and *you* in indirect and direct speech reports. The latter type of speech report requires an additional perspective shift from the perspective of the actual speaker to the perspective of the reported speaker. Since this additional perspective shift is necessary to select the correct referent of a deictic pronoun in direct speech reports (Köder et al., 2015), it was hypothesized that in direct speech reports children with ASD would interpret *I* as *you* and *you* as *I*. Thus, pronoun reversals were predicted to occur in pronoun interpretation. As predicted, we found that, compared to their TD peers, primary school-aged children with ASD had more problems interpreting *I* and *you* in the perspective-shifting situations presented by direct speech reports, resulting in pronoun reversals in interpretation. It was also investigated which cognitive processes could be involved in the interpretation of deictic pronouns in direct speech reports. We found that verbal ability, working memory and IQ
help children to interpret deictic pronouns in general. A better ToM understanding seemed to explain why primary school-aged TD children are more capable than primary school-aged children with ASD to interpret I and you in perspective-shifting situations. The findings of this study suggest that children with ASD have problems with the interpretation of the deictic pronouns I and you in direct speech because of perspective-shifting problems. As is the case with pronoun reversals in production (Tager-Flusberg et al., 2005), reversals in pronoun interpretation may be longer-lasting in children with ASD than in TD children. Possibly, pronoun reversals in comprehension and production are longer-lasting in children with ASD than in their TD peers because of problems with perspective taking in children with ASD, as indicated by their poorer ToM abilities.

Study 3 (Chapter 4) addressed children’s interpretation of the perspective-independent spatial prepositions in ‘in’ and op ‘on’ and the perspective-dependent spatial prepositions voor ‘in front of’ and achter ‘behind’ from their own perspective as a hearer or from the contrasting visual perspective of the speaker. To interpret perspective-dependent prepositions from the speaker’s contrasting visual perspective, hearers could shift from their own perspective to the speaker’s perspective. A pilot study with TD adults suggested that in these situations the mature interpretation of perspective-dependent spatial prepositions is one in which the hearer takes the speaker’s contrasting visual perspective. To achieve a mature understanding of the prepositions voor ‘in front of’ and achter ‘behind’, the child should shift from his own visual perspective to the speaker’s contrasting visual perspective to interpret the prepositions from that perspective. In our study it was hypothesized that children with ASD less often than their TD peers interpret perspective-dependent prepositions from the speaker’s perspective. However, we found no support for this hypothesis. Children with ASD as well as their TD peers interpreted perspective-dependent prepositions from their own visual perspective instead of from the speaker’s contrasting visual perspective. We found that a better ToM understanding seems to contribute to a mature interpretation of spatial prepositions in general. Furthermore, cognitive inhibition and cognitive flexibility seem to be needed to shift perspective and interpret perspective-dependent prepositions from the speaker’s contrasting visual perspective. The findings of this study suggest that not only young children or children with ASD, but all children until at
least adolescence predominantly interpret perspective-dependent prepositions from their own visual perspective. The mature interpretation of perspective-dependent spatial prepositions seems to require perspective taking as well as cognitive inhibition and flexibility skills.

Finally, in Study 4 (Chapter 5), we investigated the interpretation of the temporal conjunctions *voordat* ‘before’ and *nadat* ‘after’ in primary school-aged children with and without ASD. Depending on the speaker’s choice of type of conjunction and clause order, speakers can use *before* or *after* to express the temporal order of events either in order of occurrence (i.e., temporally congruent) or out of order (i.e., temporally incongruent) (Münte et al., 1998). Previous research showed that interpreting temporal conjunctions in an incongruent order is difficult for TD children (Blything et al., 2015; Clark, 1971; Pyykkönen & Järvikkivi, 2012). It has been argued that in these situations hearers need perspective-taking skills to shift one’s own perspective in time to alternative temporal perspectives (McCormack & Hoerl, 1999). Based on this account, it was expected that the interpretation of an incongruent temporal order involves ToM understanding. Because a perspective shift is involved, it was predicted that children with ASD have even more problems than their TD peers interpreting temporal conjunctions in an incongruent order. In contrast to these predictions, children with ASD were found to have more problems than their TD peers interpreting temporal conjunctions in general, but not specifically in an incongruent order. We also investigated which cognitive processes are involved in the interpretation of temporal conjunctions. We found that working memory, IQ and verbal ability helped children with ASD and TD alike in their understanding of temporal conjunctions. ToM understanding was needed in the interpretation of temporal conjunctions in an incongruent order, indicating that perspective taking is involved. This could suggest that hearers need perspective-taking skills to shift to a different point in time. Alternatively, hearers could need perspective-taking skills to find out why the speaker presented the events out of order.

6.3 The link between Theory of Mind and perspective taking in language

The finding that ToM understanding is needed to interpret deictic pronouns, spatial prepositions and temporal conjunctions supports the view that perspective taking is involved
in the interpretation of these linguistic expressions. Interpreting these linguistic expressions requires that the hearer considers alternative perspectives to his or her current perspective. The results of this dissertation suggest that a sufficient ToM understanding enables the hearer to consider 1) the alternative perspective of the reported speaker, which is needed to select the correct referent for deictic pronouns in direct speech reports; and 2) either one’s own alternative temporal perspective or the speaker’s perspective, which is needed to correctly interpret temporal conjunctions in an incongruent order. These findings imply that, as argued in Chapter 1, the interpretation of deictic pronouns and temporal conjunctions in perspective-shifting situations involves linguistic perspective taking. The role of ToM understanding is different in the interpretation of spatial prepositions. To achieve a mature understanding of perspective-dependent as well as perspective-independent spatial prepositions, a sufficient ToM understanding seems to be important. This different role of ToM understanding in the interpretation of spatial prepositions may be caused by the optionality of perspective-taking in the interpretation of perspective-dependent spatial prepositions.

The findings of Chapter 2 suggest that children with ASD have a genuine ToM deficit, explaining why children with ASD have difficulties interpreting linguistic expressions that involve perspective taking. It has been proposed that a ToM deficit explains the social and communication impairments in individuals with ASD (Baron-Cohen, 1995; Frith, 2001). Moreover, pragmatic impairments in children with ASD have been linked to deficits in ToM understanding (Happé, 1993; Tager-Flusberg, 1996, 2000). According to Tager-Flusberg (1996; p.170), knowledge that speakers and hearers have different perspectives and roles in discourse is impaired in children with ASD due to “the lack of mentalistic understanding about people’s unique conceptual perspectives, which is highlighted in the characteristic errors that children with autism make in reversing deictic pronouns, such as referring to themselves as you”. She claims that among those autistic individuals who acquire functional language, certain language deficits, that reflect their ToM impairments, remain. Altogether, our results confirm these ideas of Tager-Flusberg (2006) and the well-established close relation between language development and ToM understanding (see the reviews of Astington & Jenkins, 1999 and Milligan, Astington, & Dack, 2007). More importantly, the
results of this dissertation extend the results of previous studies by showing that ToM understanding is needed to interpret linguistic expressions that involve perspective taking and that the well-known ToM impairments in children with ASD are not entirely due to poor verbal abilities. Although language development and ToM understanding are closely related, we found that ToM differences in children with ASD and their TD peers may disappear when the differences in language abilities are accounted for (contra Gernsbacher & Pripas-Kapit, 2012; Norbury, 2005; Tager-Flusberg & Sullivan, 1994).

6.4 Perspective taking in language in children with ASD
The main aim of this dissertation was to investigate whether children with ASD have more problems than their TD peers to interpret linguistic expressions that are argued to involve perspective taking. It was hypothesized that children with ASD have difficulty to shift perspectives and therefore have problems interpreting deictic pronouns, spatial prepositions and temporal conjunctions in perspective-shifting situations. The study on pronoun interpretation (Chapter 3) provides support for this hypothesis. Children with ASD have more problems than their TD peers interpreting deictic pronouns in perspective-shifting situations. Our findings suggest that pronoun reversals in comprehension and production are longer-lasting in children with ASD than in TD children because of perspective-shifting problems.

The study on temporal conjunctions (Chapter 5) provides partial support for this hypothesis. Children with ASD had more problems than their TD peers interpreting temporal conjunctions. Also, we found that the interpretation of temporal conjunctions in an incongruent order is associated with ToM understanding and thus seems to require perspective taking. As children with ASD have difficulty with ToM understanding, we expected (similarly to the situation with deictic pronouns) that children with ASD have difficulty to shift perspectives and therefore have problems interpreting temporal conjunctions. However, we did not find that children with ASD have more problems than their TD peers when interpreting temporal conjunctions in an incongruent order. It could be that this study was underpowered to detect specific differences between children with ASD and their TD peers, due to large individual differences in performance in the ASD group.
Those children who had problems interpreting temporal conjunctions in an incongruent order were mostly, but not exclusively, children with ASD. Our findings therefore are compatible with the view that children with ASD have difficulty to shift perspectives and therefore have problems interpreting temporal conjunctions in perspective-shifting situations.

Finally, the study on spatial prepositions (Chapter 4) does not seem to support the hypothesis of linguistic perspective-shifting problems in children with ASD. The interpretation of the perspective-dependent spatial prepositions *in front of* and *behind* is challenging for children with ASD as well as for TD children when hearer and speaker have contrasting visual perspectives. Why were no differences found in the interpretation of these spatial prepositions between children with ASD and their TD peers? First of all, it could be argued that when it is not strictly necessary for the hearer to engage in perspective taking, as with spatial prepositions, children will interpret the prepositions from their own visual perspective. In the spatial preposition task, children were not explicitly instructed from whose perspective they should interpret the situation, as is also usually the case in daily life. Perspective-dependent spatial prepositions are ambiguous and allow an interpretation from the hearer’s perspective as well as from the speaker’s contrasting perspective. Whereas adults tend to interpret these prepositions from the speaker’s perspective, it is conceivable that children do not engage in perspective taking and thus interpret the prepositions from their own perspective.

Second, it could be that some children in our study expected the speaker to take the hearer’s perspective, that is the child’s perspective, into account. These children might have assumed that the speaker described the situation from the child’s perspective as a hearer, instead of from the speaker’s own perspective. If this is the case, these children’s interpretations of the spatial prepositions *before* and *after* would be an indication of perspective taking. That is, it may only seem as if these children interpreted these prepositions from their own perspective. This explanation suggests that children with ASD are able to engage in perspective taking to interpret perspective-dependent spatial prepositions from the speaker’s perspective.

Third, it is possible that some children interpreted *before* and *after* from their own
perspective because they had problems ignoring their own visual perspective when judging the speaker’s contrasting visual perspective. The latter explanation will be clarified in relation to the cognitive processes needed to interpret spatial prepositions from another person’s perspective, which will be discussed in the next section.

6.5 Cognitive processes in perspective taking in language

The main aim of this dissertation was to investigate whether children with ASD have more problems than their TD peers to interpret linguistic expressions that are argued to involve perspective taking. A second aim was to examine which higher-order cognitive processes, such as ToM understanding, working memory, cognitive inhibition and cognitive flexibility, may contribute to linguistic perspective taking, in particular to the ability as a hearer to shift to an alternative perspective (e.g., the speaker’s) and to take this perspective into account.

Next to ToM understanding, other cognitive processes might be relevant for linguistic perspective taking. Hearers need sufficient cognitive inhibition and cognitive flexibility skills to interpret spatial prepositions from the speaker’s perspective (Chapter 4). This suggests that for the interpretation of spatial expressions, hearers need to inhibit their own (egocentric) perspective and shift to the speaker’s contrasting visual perspective in order to interpret spatial expressions from this contrasting perspective. In contrast, hearers do not require inhibition and flexibility skills to interpret deictic pronouns (Chapter 3) or temporal conjunctions (Chapter 5). On the basis of these findings, it could be argued that inhibition and flexibility skills do not contribute to linguistic perspective taking. While the three studies (Chapter 3, 4 and 5) all addressed the interpretation of perspective-dependent linguistic expressions, the difference among them is that only the spatial preposition task (Chapter 4) involves visual perspective taking. It could be that inhibition and flexibility skills contribute to visual perspective taking. Possibly, seeing a particular configuration of objects from one’s own visual perspective makes it hard to shift to another person’s visual perspective (e.g., Surtees, Samson, & Apperly, 2016). It is conceivable that hearers need inhibition skills especially when actively having to inhibit their own visual perspective in order to shift to another person’s contrasting visual perspective. Support for this argumentation can be
found in our ToM study (Study 2), where inhibition skills were found to be required for taking the computer’s contrasting perspective in the low-verbal but highly visual ToM task. Extending the results of previous studies that found a role of self-perspective inhibition in ToM (Fizke et al., 2014; Rakoczy, 2010), our results suggest that self-perspective inhibition is crucial when the other person’s visual perspective conflicts with one’s own, dominant, visual perspective. This could also explain why children had difficulties to shift from their own visual perspective to interpret spatial prepositions from the speaker’s contrasting visual perspective. These results provide more insight into the role of self-perspective inhibition in perspective taking, whether this is a visual, cognitive, emotional or linguistic perspective. As far as known, we are the first to show the relation between visual perspective taking and inhibition and flexibility skills empirically.

As mentioned above, our findings indicate that hearers do not require inhibition and flexibility skills to interpret deictic pronouns (Chapter 3) or temporal conjunctions (Chapter 5). In Chapter 3 of this dissertation, it is argued that the absence of a relation between pronoun interpretation and cognitive inhibition or cognitive flexibility suggests that in the clinical diagnosis of ASD, pronoun reversals should not be approached as a restricted, repetitive pattern of behavior like echolalia (see DSM-5; APA, 2013). Restricted, repetitive behaviours in ASD, including repetitive speech (echolalia), have been found to be related to a reduced cognitive flexibility and inhibition problems (Miller et al., 2015; Mosconi et al., 2009). Our results indicate that pronoun reversals most likely result from perspective-shifting difficulties. We therefore propose that in the clinical diagnosis of ASD, pronoun reversals are best classified as a social communication problem rather than a repetitive behavior. Note that in the clinical diagnosis of ASD there is no reference to difficulties with the interpretation of temporal expressions. This matter will be discussed in the section Relation to DSM-5 and clinical diagnosis below.

6.6 Methodological limitations
A first limitation in this dissertation is that the use of a cross-sectional design limited us in drawing conclusions about developmental patterns in language comprehension, ToM understanding and EF. Developmental patterns, in turn, provide insight into possible causal
patterns. The findings in this dissertation suggest that ToM understanding is needed to interpret deictic pronouns, spatial prepositions and temporal conjunctions. Cognitive inhibition and cognitive flexibility seem to aid in a better understanding of linguistic expressions from another person’s contrastive visual perspective. Given our design, it is not possible to draw conclusions about possible causal patterns. A developmental design, provided that the sample size is large enough, may give further insights into potentially causal processes playing a role in the associations among ToM, cognitive inhibition, cognitive flexibility and the interpretation of perspective-dependent linguistic expressions. It could, in addition, be true that different cognitive processes contribute to improvements in language comprehension in early development than in later development. Therefore, future studies may extend our findings by examining children’s interpretation of linguistic expressions that involve perspective taking in a longitudinal study. Such studies should unravel the reciprocal effects among linguistic abilities, ToM and EF over time.

A second limitation is that our associations of ToM understanding with the interpretation of deictic pronouns, spatial prepositions and temporal conjunctions are based on a verbal ToM task. Good ToM understanding has been related to linguistic abilities in children with ASD and TD children (Happé, 1995; Miller, 2013; Milligan et al., 2007; Ronald et al., 2006). Thus, it could be argued that the associations we found between the interpretation of deictic pronouns, spatial prepositions and temporal conjunctions, on the one hand, and ToM understanding, on the other hand, merely point to the role of linguistic skills in ToM understanding. This argumentation would hold for the general effect of ToM understanding on the interpretation of spatial prepositions. However, it does not explain the specific effects of ToM understanding on the interpretation of temporal conjunctions in an incongruent order and deictic pronouns in direct speech reports. These specific situations require that the hearer shifts perspective. If the observed associations with ToM would simply indicate that sufficient verbal abilities are needed for ToM understanding, an association of ToM understanding with the interpretation of deictic pronouns in indirect speech and the interpretation of temporal conjunctions in a congruent order would be expected as well. Unfortunately, and as argued in Chapter 2, there are no standard second-order ToM tasks that do not largely rely on verbal abilities. Therefore, we chose to use a
standard high-verbal ToM task (i.e., a false belief task) in Chapters 3, 4, and 5 in order to be able to embed our findings in the overall literature. It would nonetheless be interesting to test whether the associations of ToM understanding with the interpretation of deictic pronouns, spatial prepositions and temporal conjunctions hold up when measures of an advanced low-verbal ToM task (such as the Marble drop task) are used instead of measures from a high-verbal ToM task.

Despite these limitations, our design, which includes multiple and diverse cognitive processes, is highly comprehensive compared to previous literature. The design and statistical approach allowed us to distinguish which cognitive processes may be needed in the interpretation of deictic pronouns, spatial prepositions and temporal conjunctions and thus to contribute novel insights to the literature on language comprehension in children with and without ASD.

6.7 Theoretical implications and future directions

The findings in this dissertation suggest that verbal children with ASD with an average intelligence (so-called “high-functioning” ASD) show difficulties with temporal conjunctions. Language difficulties in individuals with ASD are mostly attributed to a pragmatic deficit. However, the interpretation of temporal conjunctions depends on the meaning of the conjunction and on clause order, making it syntactic/semantic in nature. In line with two previous studies (Boucher, 2012; Durrleman et al., 2015), our findings indicate the need to investigate language problems in individuals with ASD beyond the well-recognized pragmatic problems.

Our studies show that the interpretation of deictic pronouns, spatial prepositions and temporal conjunctions involves ToM understanding (Chapter 3, 4 and 5). It follows that ToM understanding is needed for language comprehension in the syntactic and semantic domain, just like it is needed for the well-recognized language problems in the pragmatic domain (Happé, 1993). Future studies could extend our work and study the relation between ToM understanding and the interpretation and production of other linguistic expressions in the syntactic and semantic domains, such as the relation between ToM understanding and the comprehension of relative clauses. Such studies will provide more understanding of
perspective taking in language and the relation between ToM understanding and linguistic abilities. More importantly, such studies could help to find out whether children with ASD struggle with other linguistic expressions in the syntactic and semantic domains that involve perspective taking.

6.8 Relation to DSM-5 and clinical diagnosis

The findings of this dissertation suggest that perspective-taking problems in children with ASD extend to domains of language beyond pragmatics. These findings emphasize the necessity for clinicians to focus on language problems in children with ASD outside of the pragmatic domain, more specifically the syntactic and semantic domain. At present, the DSM-5 (APA, 2013) divides the language problems that are part of the diagnosis of ASD into social communication problems (criterion A1: failure of normal back-and-forth conversation and A2: abnormal prosody) and repetitive behavior (criterion B1: stereotyped or repetitive speech, echolalia, idiosyncratic language use). Pragmatic language problems, such as the production of ambiguous pronouns (Kuijper et al., 2015), fall under the umbrella of social communication problems. Pronoun reversals are mentioned in the DSM-5 as an illustration of repetitive speech (APA, 2013; p.54). Other language problems in ASD can be indicated by adding the clinical specifier "language impairment" as an independent feature to the diagnosis. The problems with the interpretation of temporal conjunctions (Chapter 5) and the syntactic difficulties found in individuals with ASD in previous studies (Durrleman et al., 2015; Eigsti & Bennetto, 2009) must then be indicated by the independent clinical specifier "language impairment". The current division of language problems in the diagnosis of ASD in the DSM-5 (APA, 2013) into three different categories seems not very helpful for gaining more insight into the origin of the language problems in ASD. This dissertation suggests that a possible commonality of the language problems falling into these three different categories is a linguistic perspective-taking deficit. Whether indeed all language problems in children with ASD are the result of a linguistic perspective-taking deficit, is left for future research.
6.9 Conclusion

The main aim of this dissertation was to investigate whether children with ASD have more problems than their TD peers interpreting linguistic expressions that are argued to involve perspective taking. The association between ToM understanding and the interpretation of deictic pronouns and temporal conjunctions in perspective-shifting situations supports the view that linguistic perspective taking is involved. Children with ASD had more problems than their TD peers interpreting deictic pronouns and temporal conjunctions in perspective-taking situations, which could suggest that their language comprehension problems may be the result of a linguistic perspective-taking deficit.

An additional aim of this dissertation was to investigate the cognitive processes that may contribute to linguistic perspective taking, in particular the ability as a hearer to take alternative perspectives such as the speaker’s into account. The findings in this dissertation suggest that a sufficient ToM understanding, but not inhibition and flexibility skills, contributes to linguistic perspective taking. When interpreting linguistic expressions that require perspective taking (Chapter 3 and 5), a hearer may need ToM understanding to become aware of the different perspectives that are available. Possibly, inhibition and flexibility skills contribute to visual perspective taking; more specifically, these processes may be needed when hearers actively have to inhibit their own visual perspective to take another person’s contrasting visual perspective.

This dissertation further shows that children with ASD have a ToM deficit which cannot be solely attributed to poor verbal skills nor to a low IQ or problems with cognitive inhibition, cognitive flexibility or working memory. This suggests that ToM impairments in children with ASD, and perspective-taking problems in general in children with ASD, are genuine. The findings in this dissertation suggest that their perspective-taking problems in language extend beyond the well-recognized problems with pragmatic communication.